

*United States Marine Corps
Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068*

MASTER OF MILITARY STUDIES

TITLE: ARMING THE KC-130: FILLING A CAPABILITY GAP OR CREATING A NEW ONE?

**SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF MILITARY STUDIES**

AUTHOR: Maj Karl T. Schmidt

AY 08-09.

Mentor and Oral Defense Committee Member: Dr. Adam Cobb

Approved: _____

Date: _____

3-20-09

Oral Defense Committee Member: Dr. Pauletta Otis

Approved: _____

Date: _____

3/20/09

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 2009		2. REPORT TYPE		3. DATES COVERED 00-00-2009 to 00-00-2009	
4. TITLE AND SUBTITLE Arming the KC-130: Filling a Capability Gap or Creating a New One				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) United States Marine Corps, Command and Staff College, Marine Corps University, 2076 South Street, Marine Corps Combat Development Command, Quantico, VA, 22134-5068				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 38	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Executive Summary

Title: Arming the KC-130: Filling a capability gap or creating a new one?

Thesis: Adapting the KC-130 with the ISR weapons mission kit will fulfill a current capability gap and produce both immediate and long term consequences. Despite these challenges, filling this capability gap can be done without creating any future gaps.

Discussion: The Marine Corps' desire to acquire the AC-130 is not new. In years past, the acquisition has proved a bridge too far for a variety of reasons. However, current operations in both Afghanistan and Iraq have reignited the debate. The dispersed nature in which Marine units are deployed makes their long supply lines vulnerable to attack. Protecting these highly dispersed units requires assets with a persistent overwatch capability like the AC-130. While acquiring the AC-130 does not make sense for the Marine Corps, another alternative is to outfit the current fleet of KC-130s with both weapons and sensors to fill this role. This was the thought process which drove the Urgent Universal Needs Statement and ultimately the development of the Intelligence, Surveillance and Reconnaissance (ISR) weapons mission kit for the KC-130. This ISR weapons mission kit will utilize the KC-130 advantages of endurance and payload capacity to produce an "AC-130 like" capability for the Marine Air Ground Task Force Commander at a fraction of the AC-130 cost. While arming the KC-130 has the potential to be a tremendous force multiplier, it will come at a price. Near term effects are significant but not insurmountable. Long term effects have the potential to change the scope of how the KC-130's are utilized.

Conclusion: The ISR weapons mission kit would fill a capability gap in Marine Corps Aviation. Despite the multitude of obstacles, this capability is worth the effort and will help posture the Marine Corps for future contingencies.

Table of Contents

	Page
Disclaimer	i
List of Illustrations.....	ii
Acknowledgments.....	iii
Background Information.....	1
ISR Weapons Kit Description.....	3
Concept of Employment.....	5
Capability Gap Further Defined.....	6
Near Term Effects.....	8
Doctrine.....	8
Organization and Personnel.....	9
Training.....	10
Material and Logistics.....	12
Funding.....	12
Long Term Effects	13
Mission Creep.....	13
Historical Basis for KC-130 Mission Creep.....	16
High Demand/Low Density.....	17
Humanitarian Assistance/Disaster Relief.....	20
KC-130 Requirements Study and Future Strategic Refueling Demands.....	21
Potential for Future Urban Fight.....	22
Conclusion.....	23
Illustrations.....	25-31
Bibliography.....	32

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

QUOTATION FROM, ABSTRACTION FROM OR REPRODUCTION OF ALL OR ANY PART OF THIS DOCUMENT IS PERMITTED PROVIDED PROPER ACKNOWLEDGEMENT IS MADE.

List of Illustrations

Figure 1. KC-130J with ISR weapons mission kit installed	25
Figure 2. Viper Concept of Operations.....	26
Figure 3. Griffin Concept of Operations.....	27
Figure 4. Warhead Damage Area.....	28
Figure 5. Concept of operations for ISR weapons kit employment	29
Figure 6. Rotary Wing range and time on station	30
Figure 7. Missions flown vs. Hours (6 plane OIF det – 1 year).....	31

Acknowledgments

I would like to thank Maj. J. P. Pellegrino from the Weapons Requirements branch (APW-61) for his in-depth knowledge and support during this process. Similarly, I would like to thank my mentor, Dr. Adam Cobb for his guidance and patience. The advice of my faculty advisor, LtCol B.J. Payne, was very much appreciated and his input as a seasoned aviator gave strength to this paper. Finally, I would like to thank the best proof reader I know of, my wife Bethany, whose steadfast love and support mean the world to me.

Arming the fleet of Marine Corps KC-130s with both weapons and surveillance equipment will fill a capability gap for Marine Corps aviation and can be done without creating any new gaps. An armed C-130 has long been a desired capability amongst the Marine Corps community. Time and again the feasibility of an AC-130 acquisition has been reviewed and time and again reality has settled the debate. The AC-130, while a formidable aircraft, is too expensive and too manpower intensive for the Marine Corps to own and operate. More importantly, the High Demand Low Density (HDLD) platform would, in all likelihood, be an asset the Marine Corps would lose control of once in theater. However, the current fight in Afghanistan and Iraq has shed new light on this debate. Marines are employed in a highly dispersed fashion in Iraq and Afghanistan making them increasingly reliant on long ground resupply lines which are highly susceptible to enemy attack. Current Marine Corps aviation assets lack the range, the loiter time or the weapons to fill the overwatch role in dispersed operations. While the AC-130 is still a bridge too far for the Marine Corps, the Commandant recently looked to adapt the KC-130J fleet to partially fill this capability gap. Adapting the KC-130J to provide Intelligence Surveillance and Reconnaissance (ISR) coverage, as well as high volume and precision fire capability will significantly enhance the Marine Air Ground Task Force (MAGTF) Commander's ability to take the fight to the enemy. This increased capability, like any change, will produce both immediate and long-term consequences. Despite these challenges, filling this capability gap can be done without creating any new ones and therefore should be pursued.

Background Information

The desire for an armed C-130 goes back several years. The KC-130 weapons requirements branch (APW-61) of Headquarters Marine Corps has briefs that date back to 1994, when General Carl E. Mundy was Commandant, which show theoretical sketches of howitzers hard mounted to

KC-130 aircraft¹. The concept has been revisited several times since, forcing APW-61 to continuously reevaluate the feasibility. Time and again, once the details were spelled out, it always became clear why the Marine Corps should not pursue acquiring the AC-130. Cost was a significant factor with each gunship ranging from \$60 million to retrofit an old KC-130, to \$120 million to procure new AC-130J aircraft.² The next major detractor was the squadron size. AC-130 squadrons have approximately 1000 members compared to a KC-130 squadron which contains around 350³. This large footprint would hinder the light and expeditionary role of the Marine Corps. Finally, there was the HDLD argument. Once the asset arrived in theater it would be consumed by the Air Component Commander and the Marine Corps would lose operational control of the asset. Losing control of aviation assets runs counter to the MAGTF concept and has always been vehemently opposed. These cons outweighed the pros and systematically undermined each successive drive to acquire the AC-130.

This same cycle repeated itself when General James T. Conway became the Commandant. However, the battlefield has changed. Marines, specifically in Afghanistan, are engaged in highly dispersed operations. Battalions and companies are far removed from support and forced to use long road networks for resupply making them susceptible to ambushes and improvised explosive device attacks. Because of these dangers, there was a need for some sort of persistent overwatch capability. Taking inventory of current platforms highlighted a gap in the ability of current platforms to provide this coverage. Fixed wing assets provide tremendous firepower and long range, but with limited on station time without aerial refueling support. Rotary wing assets provide tremendous firepower, but lack on station time and range. Marine Corps unmanned

¹ Major Jeffrey P. Pellegrino, "KC-130J ISR/Weapon Mission Kit Transition Task Force" (brief, Transition Task Force meeting, The Washington Technology Park Auditorium, Chantilly, VA, December 3, 2008).

² Major Adam Holmes, "USMC AC-130 Gunship Concept" (brief, APW-61, Headquarters Marine Corps, January 3, 2005).

³ Ibid

aerial systems provide on station time, but are range limited and are unarmed. The inability to support distributed operations in Afghanistan with current assets and the unlikelihood of acquiring an asset like the AC-130 led General Conway to pursue a middle road solution with the KC-130.

This ultimately spurred the Urgent Universal Needs Statement (UUNS) #08198UB⁴ which stipulated a need for direct fire support from KC-130J aircraft. Specifically, it called for increased on station time, a precise ISR capability, and, as the combat situation dictates, a high volume of aviation fires. The UUNS made four stipulations regarding the acquisition of specific systems. First, the fire control systems selected must utilize a roll-on/roll-off platform making the additions to the aircraft non-permanent and capable of moving between aircraft. Second, all systems would only be selected from assets that were already in use in the USMC and Department of Defense. This would eliminate the cost for new research and development. Additionally, this program should never impede upon the KC-130's primary mission of aerial refueling or its secondary mission of assault support. The final stipulation was the timeline. The Commandant's intent was to have this system in place by spring/summer of 2009 to be utilized in Operation Enduring Freedom (OEF) operations in Afghanistan⁵.

ISR Weapons Kit Description

With the problem now formally framed by the UUNS, APW-61 turned to industry for proven system solutions along three broad categories: ISR, high volume fires, and precision fires.

The system selected to provide an ISR capability is the Targeting Sight Sensor (TSS). This system is an infrared sensor which will be employed on the upgraded AH-1Z helicopter⁶ and will

⁴ LtCol Dave O'Brien, MARCENT G-5, *Urgent Universal Needs Statement #08198UB*, July 21, 2008.

⁵ In late December the program was put on hold due to a denial in funding from Congress. While funding is almost through the approval stage, attaining the summer deployment timeline will be difficult.

⁶ Pellegrino, "KC-130J ISR/Weapon Mission Kit Transition Task Force"

attach to the left hand external fuel tank of the KC-130 (see Figure 1). It will provide for target prosecution and can serve as a conduit for intelligence collection or a spotting platform for other platforms. All of the other on board weapon systems will take their targeting cue from the TSS. The targeting data from the TSS will be fed to a fire control console which will be palletized and rolled onto the back of the aircraft. From this console, the Fire Control Operator (FCO) will identify targets and select the appropriate weapons system.

The Bushmaster II 30 millimeter cannon will provide the high volume of fires and will be incorporated in the left hand paratroop door (see Figure 1). This system is currently being utilized on the Expeditionary Fighting Vehicle and the San Antonio Class Ships (LPD-17). This cannon has a trainable mount and will be integrated with the fire control system.

Precision fires will come from two sources. First is the AGM-114P Hellfire II missile which will be fired from wing pylons initially located in place of the left hand refueling pod and then eventually moved outside of both In Flight Refueling Pods. Each pylon can hold up to four hellfire missiles (see Figure 1). The "P" variant Hellfire can be launched from altitudes as high as 25,000 feet. The other precision fires will come from two variations of Stand Off Precision Guided Munitions (SOPGM), the Viper Strike and the Griffin. The Viper Strike is a gravity released munition which utilizes the global positioning system, a parachute release system and a ground laser designation to locate and destroy the target with a 2.2 pound warhead⁷ (see Figure 2). The Griffin, is similarly employed, but has the added capability of a rocket to extend the range and a 13 pound warhead⁸ (see Figure 3). The small warhead is perfect for low intensity

⁷Military Periscope, s.v. "Viper Strike." <http://www.militaryperiscope.com/weapons/missrock/landatk/w0006631.html> (accessed December 17, 2008).

⁸Data on the Griffin was not available. All information was derived solely from Major Pelligrino's TTF brief on 3 Dec 2008

environments. A precise weapon with such a small warhead limits collateral damage in an urban terrain (see Figure 4).

Concept of Employment

The ISR weapons kit, or KC-130J(A)⁹, concept of employment is divided into two categories both of which involve a low threat environment (see Figure 5). The first is in a non-permissive environment during either day or night. Given this setting, the weapons kit will be utilized at high sanctuary altitudes where the aircraft is above any surface launched threat. At this high altitude, 15 to 25 thousand feet for example, the aircraft will utilize the TSS as an ISR overwatch tool. If a target is spotted, the crew can pass this information along to other fixed wing aircraft for prosecution or utilize its own precision munitions. Additionally, armed with these weapons, the potential exists to prosecute targets in the terminal environment should the situation arise. The second category of employment is in the permissive day and night environment. In this scenario, the ISR and precision guided munitions could still be utilized, but the 30 mm cannon could also be used. The reason the cannon is designated as a permissive only weapon is because of the altitude from which it is employed. Without a permissive environment, the typical employment altitude will range from 6,000 to 10,000 feet and place the aircraft within many threat envelopes¹⁰.

The other important point to note about employment is that this modification to the aircraft is minor and will be applied to all squadron aircraft. Therefore, while initial procurement will only provide three ISR weapons mission kits per squadron, the kits can be used on any aircraft and

⁹ Currently no official name exists to describe the armed KC-130 variant. Rather than continuing to refer to the concept as "the ISR weapons kit" the title "KC-130J(A)" will be used from this point forward unless specifically referring to some aspect of the kit. Utilizing the label "AKC-130" was omitted as it would give the false impression that this is a permanent aircraft modification. Additionally, placing the "attack" initial before the "refueling" and "cargo" initials might imply a priority of missions which runs counter to the guidance of the UUNS.

¹⁰ For example, the SA-7 man portable surface to air missile has a maximum altitude between 9,842 and 14,764 feet depending on variation. Military Periscope, s.v. "SA7." <http://www.militaryperiscope.com/weapons/missrock/antiair/w0004262.html> (accessed March 19, 2009).

can be tailored to the mission. If it is a non-permissive environment, perhaps only the TSS and the SOPGM will be loaded. If it is a permissive environment, then perhaps the 30 mm cannon will be added. Not only is it tailorable to the mission, but by no permanent weapons being affixed on the aircraft the primary mission of aerial refueling and the secondary mission of assault support can be maintained¹¹.

Capability Gap Further Defined

As previously stated, the decision to utilize the KC-130s for this capability was driven by the drawbacks in other USMC platforms ability to perform the overwatch function. Each aviation platform is either not capable of being adapted or it is too costly to do so. To further frame this debate, each of these platforms shortcomings and solutions will be examined.

The Marine Corps fleet of UH-1 Hueys and AH-1 Cobras provide a substantial amount of firepower as well as significant sensing capability to perform the overwatch role. The biggest drawback with these platforms is their range and time on station. Figure 6 illustrates the Cobra and Huey ranges superimposed over the map of Afghanistan as well as an estimated time on station available. Depending on how dispersed the individual units are, this overwatch role becomes extremely limited. Extending this coverage requires extra aircraft as well as extra refueling points as there is not a material solution to produce the range required from a rotary wing platform.

Marine Corps fixed wing assets, the AV-8B Harrier and the F/A-18 C/D Hornet, possess tremendous firepower and sensing capability and adequate range, however their major deficiency is in time on station without aerial refueling. Depending on configuration of the aircraft and

¹¹ While the "attack" mission could be combined with aerial refueling or logistics missions, it is unlikely and will be discussed later in the paper.

profile of the mission, endurance can vary between two to three hours.^{12 13} While time on station is extended with the addition of aerial refueling, additional aircraft are needed to provide continuous overwatch while aircraft perform in flight refueling. To cover an eight hour overwatch role might require four fixed wing assets and a KC-130. Thus, from a resource conservation standpoint, using five aircraft in this fashion does not make long-term sense if a single KC-130J(A) can do the same job¹⁴.

The Marine Corps Unmanned Aerial Systems (UAS) possess neither the range nor the firepower to perform the overwatch role. The most capable Marine Corps UAS is the RQ-7A/B Shadow. Depending on the version, the endurance time ranges between five and seven hours and has an operational radius of 69 miles.¹⁵ It has a limited payload capacity of approximately 60 pounds which make it solely an ISR platform as it is unable to carry the precision munitions.

A potential solution does exist for the overwatch role in the next tier of systems such as the MQ-1C Sky Warrior or the MQ-9 Reaper (PREDATOR B). These systems, operated by the Army and the Air Force, have long endurance capabilities enabling the platforms to stay airborne for 30 hours. Also, the carrying capacity of these systems is around 1000 pounds for the Sky Warrior and over 3,500 pounds for the Reaper. Because of this payload capacity, each system can carry an array of precision guided weapons. The Sky Warrior can carry four Hellfire missiles while the Reaper can carry eight Hellfire missiles and four precision guided bombs¹⁶. Neither system has the ability to carry a high volume fire weapon, such as a cannon. These systems

¹² Military Periscope, s.v. "F/A-18." <http://www.militaryperiscope.com/weapons/aircraft/fighter/w0002868.html> (accessed January 23, 2009).

¹³ Military Periscope, s.v. "AV-8B." <http://www.militaryperiscope.com/weapons/aircraft/attack/w0003089.html> (accessed January 23, 2009).

¹⁴ This is assuming that all aircraft are covering the same target area. Multiple target areas will be discussed later in the paper.

¹⁵ Military Periscope, s.v. "RQ-7A." <http://www.militaryperiscope.com/weapons/aircraft/rpv-dron/w0004690.html> (accessed December 17, 2008).

¹⁶ No data currently exists which stipulates SOPGM carrying capability.

however, have many characteristics that are impractical for USMC acquisition. The cost ranges from around 100 million per Sky Warrior system and 200 million per Reaper system^{17 18}. These systems are not expeditionary in nature¹⁹ and need a paved runway from which to operate. Additionally, these systems are HDLD assets and would prevent sole use by the Marine Corps once they were deployed in theater. The cost, the lack of expeditionary nature and the HDLD nature of these assets make it a poor fit for Marine Corps aviation.

The current inventory does not support the persistent overwatch role without significant stretching of its present assets or the costly acquisition of a new one. The addition of the ISR weapons kit would make the KC-130 ideally suited for such a role. Making such a shift is not without its problems however, and will present many challenges. Some are obstacles which present themselves in the near future. Others will have long-term impacts which can only be theorized at this point. The next section will examine both the near and long-term effects of making such a change.

Near-Term Effects

The immediate obstacles to acquiring the KC-130J(A) are significant, but not insurmountable. The acronym DOTMLPF (Doctrine, Organization, Training, Materiel, Logistics, Personnel and Funding) concept will be used here to help assess the near-term effects or consequences.

Doctrine

Utilizing the KC-130J(A) will not require significant changes to Marine Corps or Joint doctrine. There is nothing extraordinary about the capabilities of the ISR weapons platform or the concept of its employment that will require fundamental changes to the way close air support

¹⁷ Pellegrino, "KC-130J ISR/Weapon Mission Kit Transition Task Force".

¹⁸ Each Sky Warrior system is composed of 12 air vehicles and 5 ground stations. Each Reaper system is composed of up to 4 air vehicles and associated equipment.

¹⁹ These systems require prepared surface, lengthy runway which may not be available in an expeditionary environment.

or ISR is currently conducted. If anything, the KC-130J(A) will enhance current MAGTF doctrine by providing another tool in the Marine combined arms arsenal for the MAGTF commander.

Organization and Personnel

Current KC-130 squadrons manning levels may need to change to handle the addition of the KC-130J(A). The shortages come from two broad categories: maintenance personnel and aircrew.

From a maintenance standpoint, there is a shortage of ordnance Marines available to handle the increase that the KC-130J(A) weapons systems bring. The current table of organization for a squadron allows for twelve²⁰ ordnance Marines to handle the defensive systems on the aircraft. This structure allows for multiple detachments of aircraft to function at several different locations. With the advent of the additional weapons, these twelve Marines may not be enough. There is additional ordnance manpower and expertise which resides at the Marine Aviation Logistics Squadron (MALS) level and could augment the flying squadrons, but permanent personnel would require restructuring the squadron Table of Organization (TO) to allow for additional ordnance expertise within the squadron, especially considering the deployable nature of this aircraft.

The current KC-130J crew consists of two pilots, a crew chief and a loadmaster. The proposed crew concept to support the KC-130J(A) would add a Fire Control Operator (FCO). The crew chief and loadmaster would be cross-trained to perform immediate action and maintenance on the cannon and SOPGM. This can be absorbed by the current squadron structure. The FCO is a newly created position and options to fill this aircrew position are currently being debated. One option is to fill this crew position with a pilot and seems logical as this structure is

²⁰ 12 aviation ordnance technicians (MOS 6531) are allotted for a KC-130J squadron as per the Table of Organization derived from the Total Force Structure Management System on 16 March 2009.

already present and easily supportable within the squadron. However, moving beyond the scope of three ISR weapons kits per squadron might require the TO be adjusted to allow for more pilots per squadron to handle the additional workload.

The other option is to create a Warrant Officer pipeline for the FCO position²¹. The two USMC KC-130 reserve squadrons still fly older model aircraft which utilizes a navigator as part of the crew composition. This navigator position is a Warrant Officer producing Military Occupation Specialty (MOS). If the Warrant Officer FCO option is selected, then the current active duty Warrant Officer navigators at these squadrons could fill the position until the new FCO field is populated. This option would require a change to the TO as well, but would be a more much longer transition as the Warrant Officer pipeline would have to be created from scratch in the KC-130J active duty squadrons²².

Training

There would be a steep learning curve for all personnel involved in employing the KC-130J(A). Marine Aviation Weapons and Tactics Squadron (MAWTS) has done a preliminary analysis of this system and determined that it will take 12 sorties to initially qualify a pilot and the same amount to qualify a FCO²³. Once they are qualified, the sorties required to retain proficiency would be drastically reduced and be accomplished with one or two sorties²⁴. The pilot and FCO sorties can be conducted concurrently and given the long endurance of the platform, several of the training codes could be combined into single sorties. For example, this

²¹ Stipulating that an officer must be utilized as the FCO is based solely on the standard set by current USMC aviation assets which employ similar firing systems. While utilizing an enlisted aircrew member to carry out such a duty is certainly feasible, it would require a mindset shift amongst the USMC aviation community as well as a TO change.

²² Another option under consideration is creating a feeder MOS to the FCO from a newly created CWO position for UAS operator. This CWO would be trained to operate both the UASs and the flight control station on KC-130Js.

²³ Captain Ryan Pope, "MAWTS Optimized Battleherc TTP and Training" (brief, Transition Task Force meeting, The Washington Technology Park (Wtp) Auditorium, Chantilly, VA, December 3, 2008).

²⁴ The training outline is a preliminary estimation conducted by Marine Aviation Weapons and Tactics Squadron which will be validated as the program comes online.

proposed MAWTS syllabus involves one KC-130J(A) sortie where the 30mm canon is utilized in a dry fire status without ammunition and the very next sortie involves a live fire with ordnance. Given the ability to remain airborne for over ten hours, these two sorties could be combined thereby reducing the overall individual sortie requirement.

If the KC-130J(A) is successful, the current squadron training model will have to change. Presently the KC-130 squadrons train their aircrew to the following nine core skills: Night systems training, Long Range Navigation (over water), Tactical Navigation (low level flight), Formation, Threat Reaction, Air to Air Refueling, Assault Landing Zone, Rapid Ground Refueling, and Aerial Delivery. To attain initial proficiency in all of these skills requires 52 sorties²⁵. These sorties, generically programmed for three hours, take approximately 150 hours of flight time to acquire, assuming there are no reflights due to maintenance, weather or proficiency considerations. With the preponderance of missions flown in support of their respective Wings, the timeline to attain proficiency in all core skills stretches the span of an entire three year tour. The current training model requires completion of all of these core skills prior to upgrading to Aircraft Commander. The squadrons work diligently to provide copilots with enough training opportunities over their first tour to allow this progression to occur. With the addition of weapons employment training, some of these core skills will have to be negated. The training model will have to shift to allow copilot training to focus more narrowly on high probability missions while more specialized missions are trained to at a later date. Making this type of change is certainly feasible but will take time.

Further complicating training matters in the near-term, is the fact that there is a shortage of munitions and at times a shortage of range time with which to train. This is due to competing

²⁵ Navy Marine Corps Directive (NAVMC) 3500.53, *KC-130J Pilot Training and Readiness Manual*, June 17, 2008, page 1-8.

demands amongst other platforms that utilize similar systems, such as the Hellfire. So, while it may take 12 sorties to qualify a pilot, the dearth of munitions and range times may prolong the time to train. The answer ultimately lies in the simulators at each home station. The current simulators are not equipped to handle this training and would need to be modified to do so. Again, this is not an insurmountable obstacle, but will take time and funding. Once the simulators are able to accommodate such training, time and resources required to train will be drastically reduced.

Material and Logistics

There will be a storage requirement to house the ISR weapons kit pallets when they are not on the aircraft to protect them from the elements²⁶. Storage space at the three active duty squadrons varies, but generally speaking the near-term solution would be to utilize any MALS storage space until new storage facilities can be produced. The absence of adequate storage is not a show stopper, but building structures to store these weapons will take time.

Logistical shortfalls will be another obstacle to overcome. In addition to the ammunition shortfalls previously mentioned, there will be an initial shortage of spare parts on the weapons systems. For example, there are a limited number of TSS pods available for deployment by next summer. Should something happen to one of those systems there is not another one readily available to replace it. This will be corrected over time, but is a near-term issue.

Funding

Funding for the KC-130J(A) is nearly complete. As of 10 March 2009, three of the four requisite congressional subcommittees have given approval for this program. Concurrence from

²⁶ The additional storage requirements for deployed units are variable based on location, mission and usage. For instance, storage capacity at current deployed locations can probably accommodate such storage, but more expeditionary settings might not. Additionally, deployed KC-130J(A)'s may keep the weapons mission kit on board the aircraft thereby negating the need for storage. Because of this variation it is not practical to make a definitive statement regarding storage shortcomings for deployed units.

the remaining subcommittee is expected shortly. Once approval is finalized, the program will continue as planned. Each ISR weapons mission kit costs roughly 13.6 million which includes all spare parts and support²⁷. These funds were redirected from other programs²⁸ to cover the purchase of the first three kits. The remaining six kits will be requested through Fiscal Year 2010 war fighting requirement funding request.

Long Term Effects

While the first order effects are by no means insignificant, they can be overcome through a variety of methods which were previously explored. The larger problems may lie in the long-term effects that a change of this magnitude may cause within the Marine Corps and Marine Corps aviation.

Mission Creep

The most obvious second order effect of introducing the KC-130J(A) is mission creep. One of the requirements in the pursuit of this weapons kit was to protect the primary role of aerial refueling and the secondary role of assault support of the KC-130. While the capability of aerial refueling and assault support will still be available, the level of support will diminish without additional aircraft.

To better illustrate this requires an examination of what a typical KC-130 detachment of four planes provide a MAGTF commander. For reference, the detachments in Iraq and Afghanistan have varied between two and six aircraft based on the requirement. Utilizing the *MAGTF Planner's Reference Manual* sustained sortie rate of 1.2, these four planes generate a sustained

²⁷ Total cost for the initial system comes to 13.6 million which includes all spare parts and support. Pellegrino, "KC-130J ISR/Weapon Mission Kit Transition Task Force".

²⁸ The funds were converted from the KC-130 Avionics Modernization Program, which has been cancelled, and the training systems range improvement program.

six sorties a day²⁹. Generically speaking, these six sorties could be divided among historical norms thereby generating four aerial refueling sorties and two assault support sorties (see Figure 7 for historical norms of six plane OIF detachment)³⁰. Assuming the detachment is sourced from one squadron and each squadron has the initial procurement of three weapons kits, the squadron would likely forward deploy two kits and keep one home to train, making two of the aircraft available for tasking as a KC-130J(A) by the MAGTF commander. That would mean that half of KC-130 sorties would have the capability of providing the weapons and ISR coverage. Assuming that the KC-130J(A) is introduced into service, the mere introduction of this asset could cut aerial refueling and assault support sorties in half.

The first question then is whether these KC-130J(A) sorties can be combined with aerial refueling or assault support. The melding of these sorties seems more feasible with assault support than with aerial refueling. Certainly a KC-130J(A) could perform some functions of assault support before or after its ISR weapon mission, however there are a multitude of restrictions which limit what can be transported alongside live ammunition on board the aircraft and would hamper this aspect of assault support. Additionally, assuming that a KC-130J(A) mission would utilize a max endurance profile in order to remain on station for extended periods of time, adding missions on top of this may drive the crew day beyond sustainable levels.

Combining aerial refueling sorties with the KC-130J(A) mission seems far less likely. A KC-130J(A) providing fuel to other fixed wing assets defeats the purpose of the ISR weapon mission by diminishing its own time on station and limiting freedom of movement. It really becomes a matter of choosing one mission or the other, not both.

²⁹ MAGTF Staff Training Program, *MAGTF's Planners Reference Manual*, MSTP Pamphlet 5-0.3 (Quantico, VA: MSTP Center, November 14, 2008), page 71.

³⁰ The historical data in Figure 7 is rather typical of tasking with 60 percent going to Aerial Refueling and 40% going towards Assault Support. Obviously, these figures are at the discretion of the MAGTF commander and can vary based on the mission.

One assumption might be that the loss of aerial refueling sorties would be a zero sum gain. By having a KC-130J(A) on station, it is performing the same mission that the fixed wing aircraft was which it was supposed to refuel and therefore the aerial refueling requirement is nullified. This assumption can only be made if all aircraft are observing the same target area. If two sections of jet aircraft are covering two separate target areas, then it cannot be replaced by a single KC-130J(A). However, covering two separate target areas for a long time period, such as eight hours, would require four jets per target because they would likely break the time period into two blocks with a section covering each block. Add in the refueling assets to extend the on station time and the total comes to ten aircraft. This "two target scenario" could be observed over the same eight hour window by two KC-130J(A) aircraft. The advantages are straight forward: less wear and tear on a tactical jet aircraft, and continuous coverage of a target area by a single aircraft.

One possible solution to free up sorties is to reduce the amount of demand. If the likelihood of fixed wing aerial refueling demands being reduced is low, then reducing assault support missions becomes the lowest hanging fruit. Reducing the demand of KC-130 assault support, specifically in regards to logistical movement, would require a fundamental change in the way the MAGTF operates. The MAGTF has come to rely on the KC-130 for its organic intratheater logistical support and a reduction in this capability will be difficult. One solution is to utilize other aircraft for the smaller personnel movements. The Marine Corps operates a fleet of C-12 and UC-35 aircraft at several air stations for transport of personnel around the world. However, not all of these aircraft possess the requisite Aircraft Survivability Equipment (ASE) to be used in environments like Iraq and Afghanistan. Equipping these aircraft with ASE has begun, with two UC-35s already receiving the ASE modification, another two UC-35s are scheduled to begin

modification at the end of 2008³¹, and six UC-12Ws will be delivered in 2010, each of which will have ASE. Equipping these aircraft with ASE will lessen the sortie demand on the KC-130 thereby freeing up sorties for ISR weapons missions.

If reducing the amount of assault support missions becomes unattainable, then the final, and most realistic solution, is to put more KC-130 assets in theater. If the hypothetical detachment of four aircraft was increased to six aircraft, the sustained sortie rate of 7.6 would allow for all competing demands to be met. While the increase in logistical footprint at the forward location would be negligible, the effects would be felt much more at the supported units at the home station of the respective Marine Expeditionary Force. These units have come to rely on the support that the KC-130 squadrons provide on a daily basis in the form of logistics and training. Removing six aircraft from a squadron with 12 total aircraft would have significant impact at the home station. However, this effect will be lessened with the recent decision to raise the total number of KC-130s per squadron to 15³² and will be discussed later. This increase, though not complete until the year 2011, would allow for the increased footprint at forward operating bases while lessening the effects at the home stations.

With the addition of the KC-130J(A), it is easy to see how competing demands will place strains on KC-130 support. While this capability may not replace the primary and secondary missions of the KC-130, the level of support will undoubtedly be affected. Given an extended time period, and continued success of the KC-130J(A), it is not hard to imagine how these priorities may shift. This may be worth the risk, considering the gain, but it is worth noting.

³¹ Deputy Commandant for Aviation, *Marine Aviation Plans and Programs Reference Guide* (Headquarters Marine Corps, May 2008), page 31.

³² Marine Corps Combat Development Center, *KC-130J Requirements Study* (Quantico, VA: MCCDC, March 2005)

Historical Basis For KC-130 Mission Creep³³

If these capabilities shift the focus of the KC-130 mission away from aerial refueling and assault support towards ISR and weapons employment, it would not be unprecedented. Since the acquisition of this airframe, the mission of the KC-130 has morphed over the decades to meet the needs of the Marine Corps. From the early days of Vietnam, the KC-130 was used to provide critical logistical support to Marines in places like Khe Sahn air base. This proved to be a costly endeavor and the risk was deemed not worth the reward.

The emphasis from the 1970's through the 1980's was placed on strategic tanking of fixed wing assets. Utilizing the KC-130s in this regard enabled entire squadrons of tactical jet fighters to self-deploy anywhere around the world. This gave the Marine Corps incredible flexibility because they were not reliant upon the United States Air Force tanker fleet to provide strategic movement.

As the Air Force refueling fleet continued to grow it became logical that they should be the entity solely responsible for strategic tanking of aviation assets. Strategic tanking by the KC-130 required an entire squadron to be deployed to move one squadron of jet aircraft. Air Force strategic tankers were now performing the same move with one or two aircraft. Thus, the Marine Corps shifted its focus to tactical refueling and assault support.

During Operation Desert Storm, the KC-130s were utilized primarily in this tactical refueling role. Placing several KC-130s in aerial refueling tracks allowed tactical Marine Aviation assets to remain on station for much longer periods of time. While it was still performing its aerial refueling role, it was much different than the strategic refueling mission which had been performed just a decade earlier.

³³ Dwight C. Neeley, "Evolution of the USMC KC-130 Primary Mission," (master's thesis, Marine Corps University, 2004), pages 7-26.

A decade later, military operations in support of Operation Enduring Freedom (OEF) in Afghanistan caused the KC-130s to shift their focus primarily to assault support. In order to secure a position within Afghanistan, Marine Corps forces utilized aviation assets to traverse 400 miles over Pakistan. The KC-130s provided the refueling and logistical bridge to make this happen by establishing several Forward Arming and Refueling Points throughout Pakistan and was a critical enabler for their success.

During Operation Iraqi Freedom (OIF), the KC-130 fleet was used in a variety of ways from tactical aerial refueling to assault support to Direct Air Support Center (Airborne). Currently operations in both OIF and OEF are employing the KC-130 in a variety of roles from fixed wing refueling to rotary wing refueling to aerial delivery of supplies to battlefield illumination to logistics support.

Thus while the capabilities of the aircraft have not changed over time, the mission emphasis has. As a utility aircraft, the KC-130 has proven it is capable of making such changes. If the nature of conflict demands an innovative solution such as the ISR weapons kit, the KC-130 can make the transition efficiently.

High Demand/Low Density

Another long-term effect that may cause the Marine Corps great consternation will be the fight that ensues if the KC-130J(A) is too successful. In a Joint environment, per Joint Publication 1 (JP 1), the Marine Corps will maintain control of its organic aviation assets, unless the Joint Force Commander deems those assets are required to fill a higher priority mission³⁴. Should the capabilities of the KC-130J(A) become so enhancing that they evolve into a HDLD scenario, it may be monopolized by the Air Component Commander (ACC) to fill those higher

³⁴ Joint Chiefs of Staff, *Joint Publication 1: Doctrine for the Armed Forces of the United States*. (Washington D.C.: Joint Chiefs of Staff, May 14, 2007), V-4.

priority missions and be stripped from the MAGTF commander once it arrives in theater. Should this happen, the results could be doubly problematic, since the MAGTF would lose not only the KC-130J(A) capability, but the aerial refueling and assault support as well.

There are two counters to the HDLD argument. First, while this asset has the potential to be of value to the Joint fight, it is unlikely that it will fall into the HDLD category. This is not an AC-130 nor does it possess that level of capability. Relevant examples can be drawn from any other organic fixed wing asset in the Marine Corps capable of providing both ISR coverage and weapons delivery. An F/A-18 Hornet, for example, loaded with a Lightning ISR pod and ordnance is not forfeited to the ACC because of its HDLD status, so it is reasonable to believe that the KC-130 would be exempt as well. Success along these lines mean that at most, the MAGTF must forfeit sorties to the ACC as outlined in JP1 for air defense, long-range interdiction, and long-range reconnaissance as well as excess sorties. While a highly valuable asset, its abilities will likely keep the KC-130J(A) out of the HDLD status and allow for continued organic control by the MAGTF commander.

While this argument is logical, to turn a blind eye to the alternative would be dangerous. In other words, assuming the KC-130J(A) will not become a HDLD asset is not an appropriate action. The best defense of this "worst case" HDLD scenario comes from the fact that the weapons kit is sold as a capability not as a platform. In other words, it is the weapons kit which would make the KC-130J(A) a force multiplier, not the KC-130 itself. If the ISR weapons mission kit is overwhelmingly successful, then this weapons kit could certainly be added to United States Air Force C-130 aircraft just as easily as it was added to Marine Corps aircraft. This type of success coupled with the low density availability would drive the Air Force to convert a fraction of its fleet to handle the addition of the same kit. The expansion of such a

capability would allow for a higher volume of assets to be placed in the hands of the Joint Commander and ultimately allow for the Marine Corps to maintain organic control of its aviation assets.

Humanitarian Assistance/Disaster Relief

Another potential long-term consequence of the KC-130J(A) is the effect it will have upon the Marine Corps' ability to participate in Humanitarian Assistance/Disaster Relief (HADR) missions. The KC-130 has played a vital role, specifically in the Western Pacific, in assisting HADR missions. Since just 2004, Marine Aerial Refueler Transport Squadron 152 based in Okinawa, Japan has participated in tsunami relief in Thailand, earthquake relief in Indonesia, mudslide relief in the Philippines, and cyclone relief in Myanmar. The ability to deliver aid to countries struggling during a great tragedy goes a long way to strengthen partnerships with our allies and to create partnerships in countries where diplomatic relations may have been strained. It is during these strained relations that U.S. military intervention, even with the best of intentions, is viewed with complete skepticism by the host nation. As an example, during the most recent disaster relief after tropical cyclone Nargis devastated the country of Myanmar, the 31st Marine Expeditionary Unit (MEU) moved toward the coast to prepare to lend assistance. The aircraft on board the MEU ships were deemed too threatening by the Myanmar government and were not granted access. Remarkably this skepticism did not extend to the KC-130. For weeks, the KC-130 provided the single source of U.S. aid to the region while the 31st MEU remained off the coast.

The non-threatening stature of the KC-130 keeps the door open in many countries that might not allow the more traditional military aircraft to enter. Adding the ISR weapons mission kit to the KC-130 may change this status. Despite the fact that all weapons are removable, the fact that

the KC-130 might be armed could be enough to prevent access to some countries. This has the potential to limit ability to engage with previous adversaries through HADR. Though this is certainly not a reason to cancel the program, it is a long-term effect worth considering.

KC-130 Requirements Study and Future Strategic Refueling Demands

The strategic tanking for fixed wing aircraft that disappeared in the mid to late 1980's may reappear in the near future due to the acquisition of the MV-22. The airspeed at which the MV-22 refuels makes it incapable of refueling behind the faster fleet of jet aircraft which make up the Air Force strategic tanking arsenal. During normal deployments, the MV-22 will deploy on board Navy ships, but for large-scale rapid deployments that necessitate both speed and volume of aircraft, the KC-130 will likely be called upon. Depending on the size of the movement, this may cause the majority of the KC-130 squadron to be committed to making this happen. For example, to move 36 MV-22's across the Pacific Ocean would require eight KC-130's³⁵. This is no small undertaking and requires persistent and dedicated training.

The solution to this anticipated increase in demand is already in progress. In 2005, a KC-130J Requirements Study was conducted by the Marine Corps Combat Development Center to study how many aircraft were needed to meet the future demands. The study considered the implication of strategic aerial refueling of the MV-22, in support of Major Combat Operations (MCO), Small Scale Contingency (SSC) considerations, training requirements and maintenance requirements. Balancing the risk of each of these considerations against available assets, the decision was made to acquire an additional three aircraft per active duty squadron raising the total from 12 aircraft to 15. The two reserve squadrons will eventually transition to the KC-130J

³⁵ Marine Corps Combat Development Center, *KC-130J Requirements Study* (Quantico, VA: MCCDC, March 2005), pages 12-13.

model, but will remain at 12 aircraft. Thus, the entire KC-130J fleet will eventually contain 69 aircraft.

The study was conducted before the KC-130J(A) concept was created and therefore does not account for this added mission. So, the obvious question is whether or not the 69 aircraft can support this additional tasking. The answer lies in how the study was conducted. The study considered the effects of two MCOs and one SSC all happening simultaneously. While this is certainly the “worst case” scenario, the likelihood of all of these events happening at the same time is low and would most likely require mobilization of the economy. More importantly, these missions are mutually exclusive. In other words, if a squadron is tasked with performing strategic aerial refueling of MV-22’s in support of MCOs there will be no chance of the competing demands for KC-130J(A) missions. This is because MCOs by their very nature are not a low enough threat environment in which a KC-130J(A) could be employed. Because of the low probability of multiple MCO and SSC occurring simultaneously as well as the mutually exclusiveness of the missions, the 69 aircraft solution is capable of adding the KC-130J(A) mission.

Potential For Future Urban Fight

While the KC-130J(A) was driven by current operational necessity to support highly dispersed operations in Afghanistan, it can also provide a host of capabilities for future contingencies. The Marine Corps has conducted significant research over the past few years in an attempt to forecast what the future battlefield will look like³⁶. These studies reveal that, in all likelihood, urban conflict will continue to increase in the future. Because of this high probability we must focus efforts to improve our ability to fight in urban terrain. These efforts were outlined

³⁶ Commandant of the Marine Corps, *Marine Corps Vision and Strategy 2025*, (Headquarters Marine Corps, June 18, 2007), page 11.

in the Commandant's *Vision Strategy 2025*:

Recent combat has confirmed the need to improve the essential fires and maneuver capabilities of Marine ground forces, especially within complex urban terrain. Schemes of maneuver in future operations will often necessitate coordinated, precise fires from ground, air, and naval surface fire support platforms. These fires must be available 24 hours a day, 7 days a week under all weather conditions and they must be able to rapidly and precisely engage the fleeting opportunities often found in irregular warfare.³⁷

The KC-130J(A)'s extended time on station, ISR capability and the unique blend of smaller precision munitions, make it ideally suited for these types of urban environments. While the future is never certain, and there is never a single silver bullet to solve all contingencies, the KC-130J(A) provides a low-cost option at the MAGTF commander's disposal with which to confront the challenges of tomorrow.

Conclusion

Current operations in Afghanistan have identified a capability gap within Marine Corps aviation which can be met by adapting the KC-130 with the ISR weapons mission kit. Doing this will introduce a host of immediate and long term consequences. The immediate consequences, though substantial, are capable of being overcome. The long-term consequences will change the way the KC-130 is utilized. Though the primary mission of aerial refueling and the secondary mission of assault support can be maintained, the ability to provide support will be hindered without additional aircraft. Shifts in mission priorities, however, are not without precedence in the KC-130 history and can be done. The capabilities of the KC-130J(A), though significant, are not likely to place it in the HDLD category and the Marine Corps will in all likelihood be able to retain operational control of this asset. The ability of the KC-130 to perform HADR could potentially be hindered as the more threatening posture may limit access to some third world

³⁷ Ibid, page 21.

MV-22 will place increasing demands on the KC-130 for strategic refueling support, the additional three aircraft per squadron will allow this support as well as the additional KC-130J(A) missions. Finally, making these types of changes to a utility asset like the KC-130 opens several options which will help the USMC posture for the contingencies of the future. In the end, the KC-130J(A) will fill a current capability gap without creating any future ones and therefore should be pursued.



Figure 1. KC-130J with ISR weapons mission kit installed. APW-61 Transition Task Force Brief, 3 December 2008.

VIPER Concept of Operations

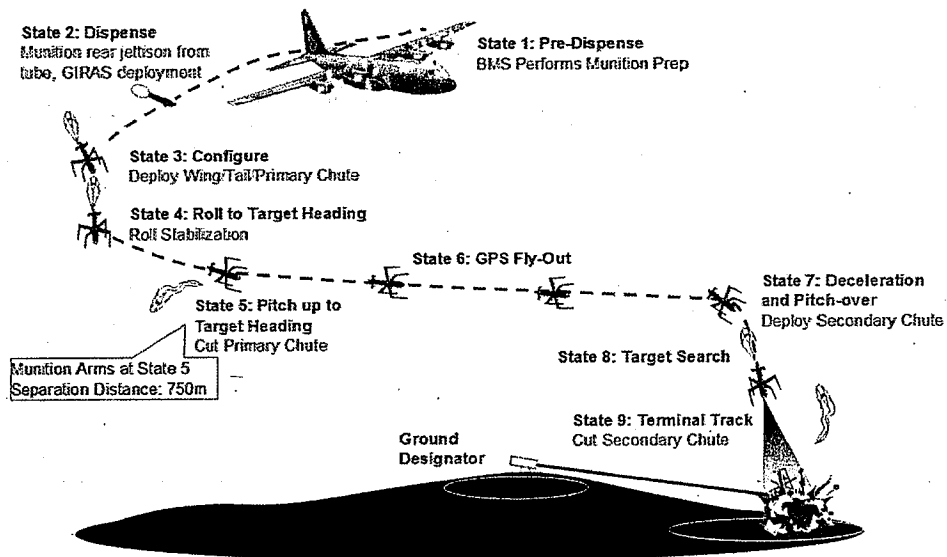
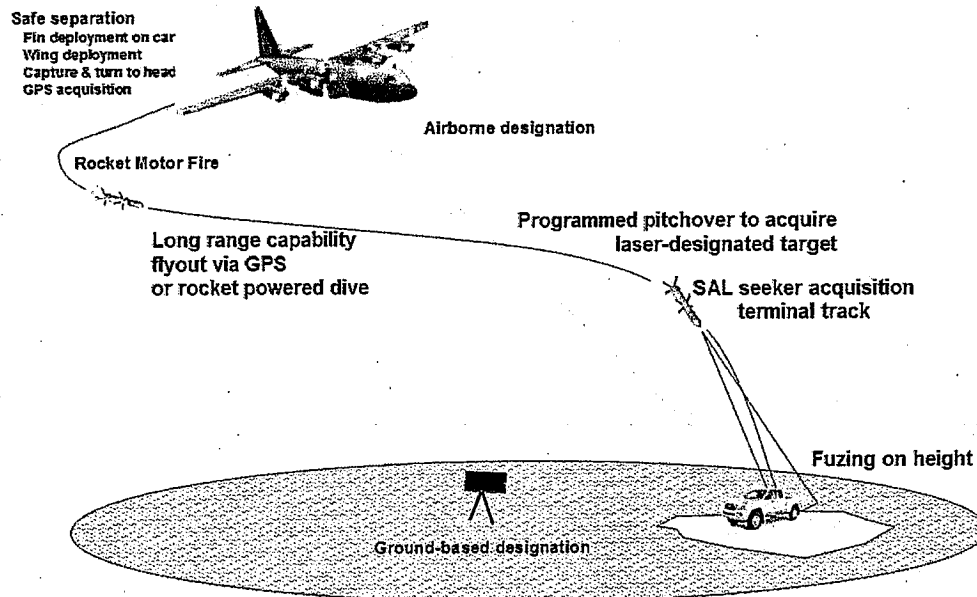


Figure 2. Viper Concept of Operations APW-61 Transition Task Force Brief, 3 December 2008.

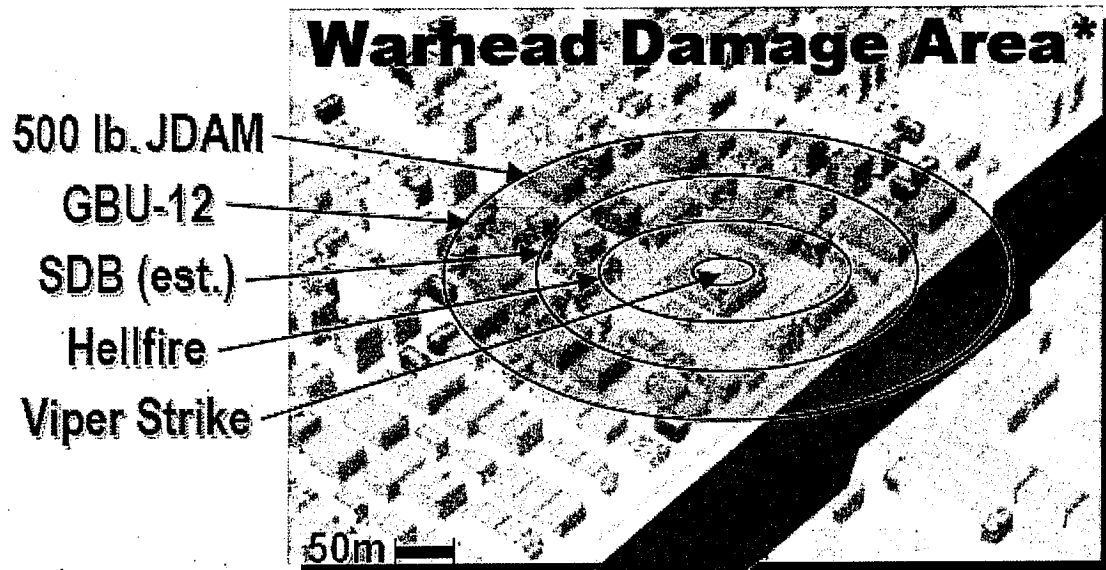
GRIFFIN

Concept of Operations



17

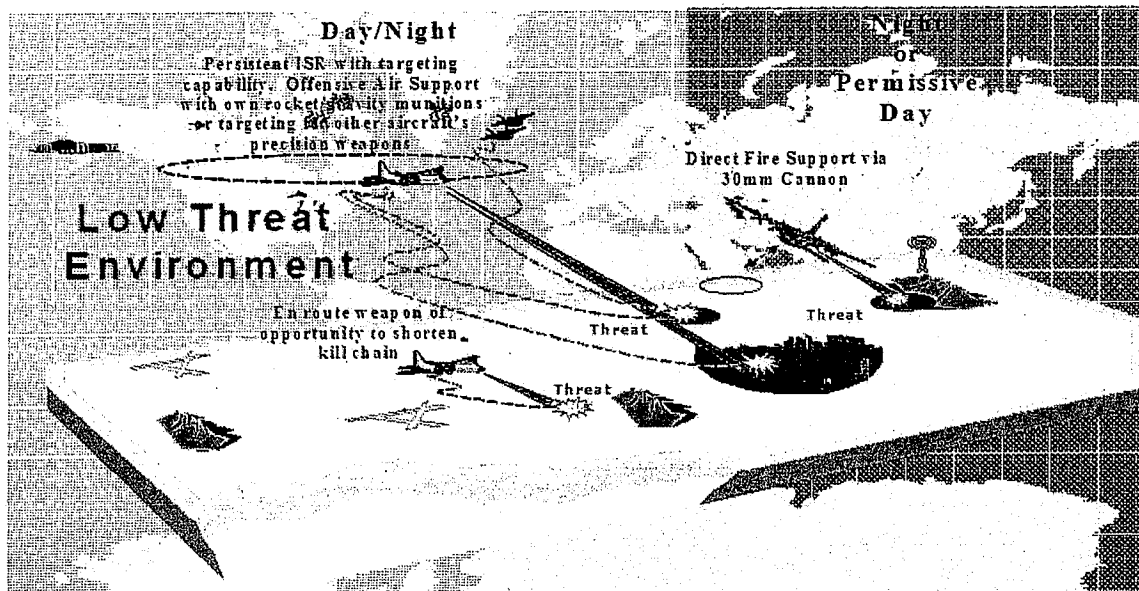
Figure 3. Griffin Concept of Operations. APW-61 Transition Task Force Brief, 3 December 2008.



**Joint Pub 3-09.3 Joint CAS (.1% PI)*

Figure 4. Warhead Damage Area. APW-61 Transition Task Force Brief, 3 December 2008.

CONOPS



22

Figure 5. Concept of operations for ISR weapons kit employment. APW-61 Transition Task Force Brief, 3 December 2008.

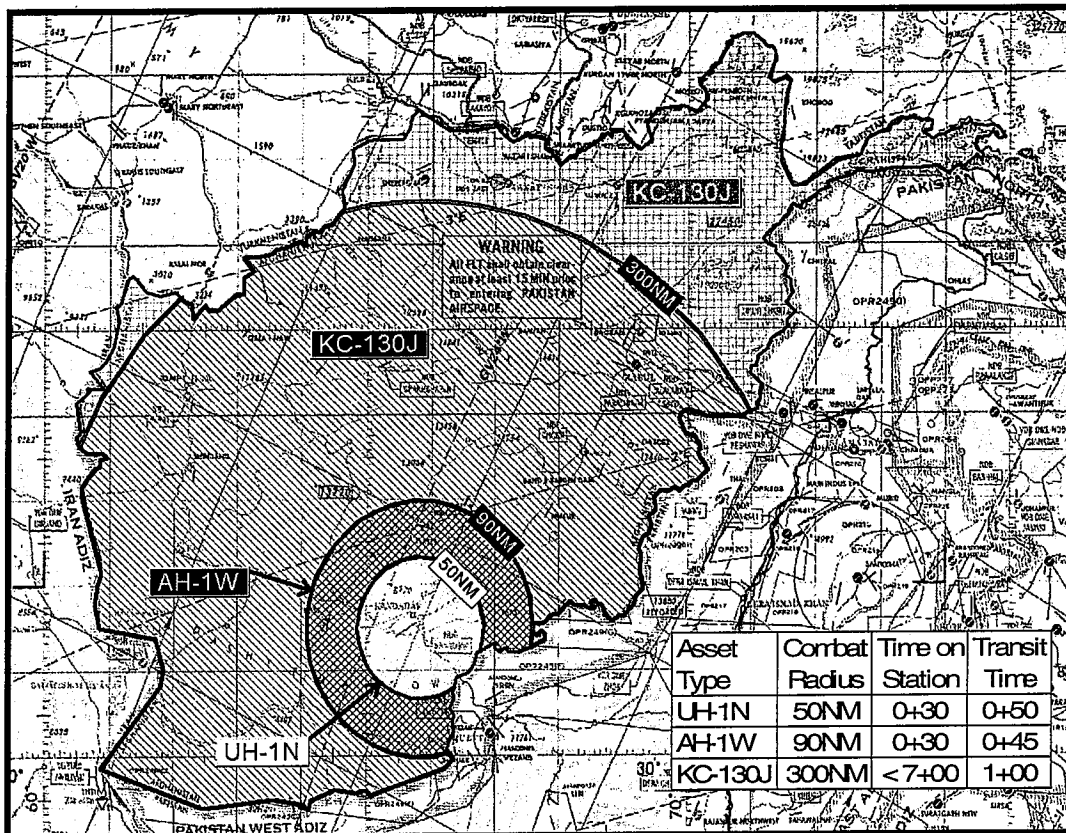
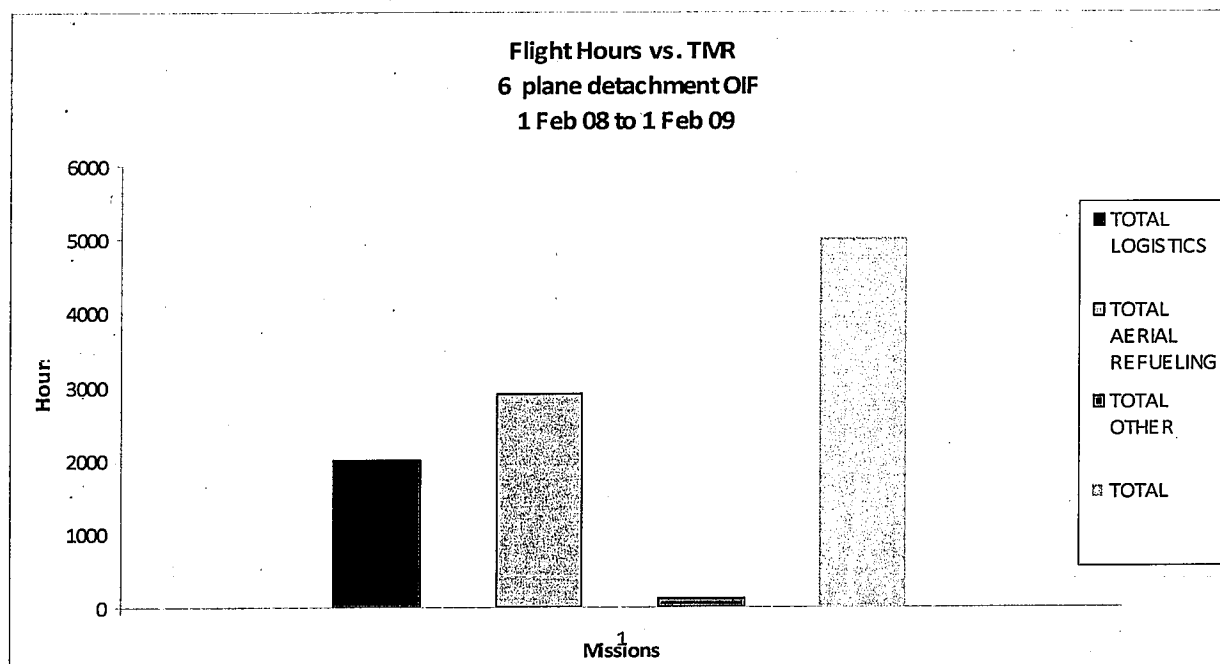


Figure 6. Rotary Wing range and time on station. APW-61 Transition Task Force Brief, 3 December 2008.



2M2	2M6	2R4	2R6	TOTAL	Percentage	
LOG MAW - (non combat)	LOG DIV (non combat)	TROOP (combat)	LOG (combat)	LOGISTICS		
221.8	1.6	560.9	1209.2	1993.5	39.8%	
				6T7	TOTAL AR	Percentage
				AR (combat)		
				2909	2909	58.1%
6T8				6T3	TOTAL OTHER	Percentage
				Battlefield Illum		
2.7				105.9	108.6	2.2%
				TOTAL		
				5011.1		

Figure 7. TMR report for 6 plane OIF detachment covering time period from 1 Feb 08 through 1 Feb 09. Marine Corps Sierra Hotel Aviation Readiness Program (M-SHARP) data retrieval, Aviation Training Branch, Quantico Va., 4 Feb 2009.

Bibliography

- Commandant of the Marine Corps, *Marine Corps Vision Strategy 2025*, Washington, DC: Headquarters U.S. Marine Corps, June 18, 2007.
- Deputy Commandant for Aviation, *Marine Aviation Plans and Programs Reference Guide*. Washington, DC: Headquarters U.S. Marine Corps, May 2008.
- Holmes, Adam (Major). "USMC AC-130 Gunship Concept." APW-61 brief, Washington, DC: Headquarters U.S. Marine Corps, January 3, 2005.
- Joint Chiefs of Staff, *Joint Publication 1: Doctrine for the Armed Forces of the United States*. Washington D.C.: Joint Chiefs of Staff, May 14, 2007.
- Marine Corps Combat Development Center, *KC-130J Requirements Study*. Marine Corps Combat Development Center, Quantico, VA, March 2005.
- MAGTF Staff Training Program, *MAGTF's Planners Reference Manual, MSTP Pamphlet 5-0.3*. Quantico, VA, MSTP Center, November 14, 2008.
- Pellegrino, Jeffrey P. (Major). "KC-130J ISR/Weapon Mission Kit Transition Task Force." Transition Task Force brief, The Washington Technology Park Auditorium, Chantilly, VA, December 3, 2008.
- Navy and Marine Corps. *KC-130J Pilot Training and Readiness Manual*. NAVMC Directive 3500.53, June 17, 2008.
- Neeley, Dwight C. (Major). "Evolution of the USMC KC-130 Primary Mission." Master's thesis, Marine Corps University, 2004.
- O'Brien, Dave (LtCol). "Urgent Universal Needs Statement #08198UB." Marine Corps Central Command G-5, July 21, 2008.
- Pope, Ryan (Captain). "MAWTS Optimized Battleherc TTP and Training." Transition Task Force brief, The Washington Technology Park Auditorium, Chantilly, VA, December 3, 2008.